PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : H04B 1/38

A1

(11) International Publication Number: WO 93/17504

(43) International Publication Date: 2 September 1993 (02.09.93)

(21) International Application Number: PCT/US92/11172

(22) International Filing Date: 23 December 1992 (23.12.92)

(30) Priority data:
846,267 27 February 1992 (27.02.92) US

(71) Applicant: MOTOROLA, INC. [US/US]; 1303 East Algonquin Road, Schaumburg, IL 60196 (US).

(72) Inventors: HYZIAK, Janusz, R. ; 9352 Margail, Des Plaines, IL 60016 (US). MORGAN, David, E. ; 2647 Sun Valley Road, Lisle, IL 60532 (US). SMITH, Steven, M. ; 3930 Charlemagne Drive, Hoffman Estates, IL 60195 (US).

(74) Agents: PARMELEE, Steven, G. et al.; Motorola, Inc., Intellectual Property Dept., 1303 E. Algonquin Road, Schaumburg, IL 60196 (US).

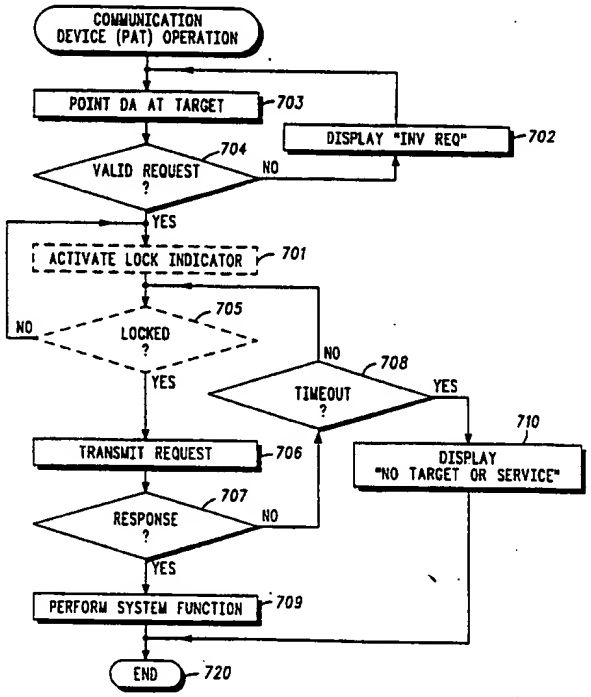
(81) Designated States: BR, CA, JP.

Published
With international search report.

(54) Title: METHOD AND APPARATUS FOR PROVIDING A POINT-AND-ADDRESS COMMUNICATION SYSTEM

(57) Abstract

A method is employed in a point-and-address communication system using a two-way communication device (100) having directional probe means (106) to establish a communication link. The method includes the step of transmitting (706), via the probe means (106), a request signal (303, 405, 504, 605) directionally toward a receiving device (200). The request signal (303, 405, 504, 605) is then received (801) by the receiving device (200), which device is in view of the user of the communication device (100). The receiving device (200) then initiates a process (808, 809) which results, either directly or indirectly, in transmission of the requested target information (304, 404) to the communication device (100). The communication device (100) then receives the requested information (304, 404) corresponding to the receiving device (200) that was seen by the user of the communication device (100).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	MR	Mauritania
AU	Australia	GA	Gabon	MW	Malawi
BB	Barbados	GB	United Kingdom	NL	Netherlands
BE	Belgium	GN	Guinea	NO	Norway
BF	Burkina Faso	GR	Greece	NZ	New Zealand
BG	Bulgaria	HU	Hungary	PL	Poland
BJ	Benin	IE	Ireland	PT	Portugal
BR	Brazil	IT	Italy	RO	Romania
CA	Canada	JP	Japan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo			SE	Sweden
CH	Switzerland	KR	Republic of Korea	SK	Slovak Republic
CI	Côte d'Ivoire	KZ	Kazakhstan	SN	Senegal
CM	Cameroon	LI	Liechtenstein	SU	Soviet Union
CS	Czechoslovakia	LK	Sri Lanka	TD	Chad
CZ	Czech Republic	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	UA	Ukraine
DK	Denmark	MG	Madagascar	US	United States of America
ES	Spain	ML	Mali	VN	Viet Nam
FI	Finland	MN	Mongolia		

METHOD AND APPARATUS FOR PROVIDING A POINT-AND-ADDRESS COMMUNICATION SYSTEM

Field of the Invention

The present invention relates generally to two-way radio communication systems, and more particularly to such a communication system which includes the capability of establishing a communication link via point-and-address techniques.

Background of the Invention

Two-way communications, as well as the infrastructure and signalling protocols to support such two-way communications, are well established in the prior art. Two-way communications systems include land-line telephone systems, radio, cellular telephony, and a myriad of combinations of these and other such systems. Communications systems of this type have been developed to satisfy the need for one communicator to communicate with a known second communicator. Examples of two-way communications include a police dispatcher calling a patrol officer, an individual placing a telephone call to a friend, and two computers sending data back and forth between remote locations. (A distinction is herein made between a selective initiation, where the sending communicator wishes to communicate with a *particular* receiving communicator, and a non-selective initiation, where the communication is broadcast

to a predetermined group of receiving devices. The following discussion will focus on the problems associated with two-way communications which are selectively initiated.)

A common problem with most two-way communications lies in the requirement for the sending communicator/device to know the identity (phone number, radio ID, etc.), for the receiving communicator. That is, the sending communicator must know ahead of time the identification (ID) of the device through which the receiving communicator will accept the call. In the alternative, the infrastructure of the communications system (resource controller, switching network, etc.), can store the ID's associated with receiving candidates for retrieval by the sending communicator. But even this arrangement presumes that the first communicator at one point knows the ID of the communicator it wishes to communicate with. The explicit input, or stored and subsequent retrieval, of the receiving end ID has proven to be an undesirable bottleneck in the process of establishing a communication link between two communication devices.

The single-most difficult problem with the radio communications systems of today is the low level of the selectivity that the transmitting device is capable of. That is, every signal which is transmitted from the transmitting device can be received by any suitably equipped receiver within range of the transmitting devices signalling power. Generally, this type of operation is perfectly acceptable when the receiving units are associated with the same group as is the transmitting unit (e.g., police officers, construction workers, etc.). However, when the receiving unit's identification is not known (receiving unit is not a member of the same group as the transmitting unit), it is impossible to reach that user. In many instances, the desire to communicate with another user is brought on by seeing the individual (e.g., a passing motorist on the highway). Even though this individual may be carrying a communication device,

communication with that individual is currently impossible unless the communication identification (ID) for the communication unit the individual is carrying is known.

Another example of this scenario might be when a family on vacation is driving past a hotel which has a vacancy. The driver, recognizing the name as being the same as one which is renowned for its reasonable rates, is unable to see the displayed telephone number for the hotel. Supposing the driver wishes to reserve what might be the last vacant hotel room, he must first find a local directory containing the telephone number, and then call the hotel to make the reservation. Alternatively, he might call directory assistance and acquire the phone number that way. Either way, however, requires additional time and effort in determining the telephone, or access, number for the unknown target.

Accordingly, there exists a need for a communication system which is able to establish a communication link between two communication devices, via some process which is not subject to the aforementioned shortcomings. In particular, a communication system which obviates the need for a first communicator knowing the unique ID associated with a receiving device controlled by a second communicator, would be an improvement over the prior art.

Summary of the Invention

The present invention encompasses a method for use in a point-and-address communication system which uses a two-way communication device having directional probe means to establish a communication link. The method includes the step of transmitting, via the probe means, a request signal directionally toward a receiving device. The request signal is then received by the receiving device, which device is in view of the user of the

communication device. The receiving device then initiates a process which results, either directly or indirectly, in transmission of the requested target information to the communication device. The communication unit then receives the requested information corresponding to the receiving device that was seen by the user of the communication device.

Brief Description of the Drawings

FIG. 1 is an isometric view of a point and address transmitter (PAT) device, in accordance with the present invention.

FIG. 2 is a simplified graphical representation of a point and address receiver (PAR) device, in accordance with the present invention.

FIG. 3 is a simplified graphical representation depicting a communication between a PAT and a PAR, in accordance with one embodiment of the present invention.

FIG. 4 is a simplified graphical representation depicting a communication among a PAT, a PAR, and a service provider, in accordance with an alternate embodiment of the present invention.

FIG. 5 is a simplified graphical representation depicting the initiation of an operation, in accordance with an alternate embodiment of the present invention.

FIG. 6 is a simplified graphical representation depicting a communication among a PAT, a PAR, and a service provider, in accordance with an alternate embodiment of the present invention.

FIG. 7 is a flow diagram depicting the operation of the PAT of FIG. 1, in accordance with the present invention.

FIG. 8 is a flow diagram depicting the operation of the PAR of FIG. 2, in accordance with the present invention.

Detailed Description of the Preferred Embodiment

FIG. 1 shows a so-called point and address transmitter (PAT) 100 in accordance with the present invention. The PAT 100 might have many of the same features of today's radio communications transceivers, including a signal processor 111, alpha-numeric keypad 101, an earpiece 102, a microphone 103, and card reader 110. PAT 100 also includes a conventional antenna 104 for transmitting and receiving radio frequency (RF) signals. Further, the PAT 100 is equipped with a probing device 106 which, while being aimed at a particular receiving device, directionally transmits a request signal. In a preferred embodiment, the probing device 106 takes the form of a highly sensitive directional antenna which is capable of selectively transmitting a request signal to a receiving device, later described, which is located anywhere within the operators visual range (e.g., line of sight ranging from 0-200 feet). In a preferred embodiment, a directional antenna, functionally similar to part number HPX1-220 manufactured by Andrew Corp., is employed to provide the transmitter with selective capability (in an alternate embodiment, this capability could be provided by an infrared transmitting device). Engaging button 107 might be used to activate the probing device 106, which device then transmits the aforementioned request signal. The request signal then propagates substantially toward a particular receiving device, which the operator of the PAT 100 intends to receive the request signal.

The type of request being made by the first communicator (e.g., return call, service info, service call, operation, etc.), is entered, in a preferred embodiment, via keypad 101. The PAT 100 might optionally be equipped with a light beam guide 105 which would serve as a feedback mechanism in determining whether or not the desired target has been properly engaged (a condition

typically referred to as being locked) by the PAT 100. This feedback means would aid in the selection process when the PAT 100 is trying to isolate a particular receiving device to which the request signal is to be transmitted. Also, PAT 100 might be equipped with a display screen 108, which might be used to display system messages, prompts, target characteristics, etc. Further, wireline access port 109 allows the PAT 100 to be interconnected with any number of wireline networks, computer terminals and networks, databases, etc.

FIG. 2 shows a simplified block diagram of a point and address receiving (PAR) device 200 in accordance with the invention. Antenna 206 is suitable for receiving directional request signals 202 and transmitting, where necessary, information back to the communication device (PAT 100), or to any number of other network services. PAR 200 might also be equipped with a display screen 204, on which system messages, prompts, request status indicators, etc. could be displayed. Further, icon area 207 (shown here as a relatively small symbol, but which could be, for example, as large as a billboard, depending on the application) depicts a graphical symbol describing the type of service(s) provided through a particular receiving device 200. That is, the display 204 and the icon area 207 provide for the requestor, via ocular inspection, pertinent system information without the requestor having to know anything more than the physical location of the PAR device 200.

Signal processing unit 205, in addition to performing common signal processing functions, decodes the inbound request signal 202, and subsequently encodes the outbound signals (e.g. wireline tones, RF signals, etc.)required for that particular request. In general, signal encoding and decoding techniques are well understood in the prior art, so their specific implementations within the scope of the invention will not be addressed. Outbound signals may be directed to a wireless

network via signal 203, such as a service provider, stand alone operation, wide area network (WAN), etc. PAR 200 may also be hard-wired to a wire-line network, such as the public switched telephone network (PSTN), a private voice/data link, etc. Finally, receiving device 200 may further be coupled to a service data base 201 which contains information about the types of services provided, valid requestor ID's, receiver operating parameters, etc.

The point and address transmitter and receiver (PAT and PAR, respectively) pair may be used to perform a number of tasks which are contemplated by the present invention. These tasks include, but are not limited to, obtaining the target device ID, initiating a service for the requestor, remotely activating an operation for the requestor, and providing the requestor with supplemental information about goods or services. All of these tasks have in common the fundamental premise of a requestor requesting from a receiver, via a process which involves physically aiming a communication device, to obtain information associated with a particular receiving device. That is, it is not important that the requestor know the ID of the receiver, but only that the requestor is able to physically aim the PAT device 100 towards the PAR device 200.

FIG. 3 shows a simplified block diagram of a process by which a requesting communication device (PAT 301) is able to acquire the communication ID of a particular target, namely receiving device 302. PAT 301 is physically aimed toward the receiving device 302, and a request signal 303 is transmitted. After receipt of the request signal 303, receiving device 302 transmits an appropriate target information response (e.g.,, the communication ID associated with receiving device 302). The communication device 301 receives the target information and operates on it accordingly (e.g., establishes a communication link with receiving device 302, stores the information, etc.). Communication types contemplated by the present invention

include, voice and data communication, as well as any other such entity which falls into the category of so-called multi-media transmissions.

An example of the foregoing embodiment might be a scene on a rural highway where a stranded motorist seeks assistance. It would be impractical, indeed impossible, for the stranded motorist to know the mobile telephone access number for each passing motor vehicle (whose driver would be in the best position to provide immediate assistance). In a particular embodiment of the present invention, the stranded motorist need only point his PAT 301 toward an oncoming vehicle to establish a communication link between himself and the driver of the vehicle. A point-and-address receiver (PAR) 302 located in the oncoming vehicle, after receiving the request signal 303, either directly contacts (e.g., return telephone call) the PAT device 301 (via the PAT 301 device ID sent as part of the request signal), or sends the PAT 301 its communication ID (as part of the target information 304). In the latter case, the PAT 301 would then be able to contact the PAR 302 by automatically dialing the received communication ID. (Of course, the oncoming vehicle may be equipped with both a PAR 302 and a PAT 301, perhaps even in the same physical housing, to provide fully point-and-address capability.)

FIG. 4 shows a simplified block diagram of a process whereby the receiving device establishes a communication link or initiates a communication, between a requestor and a remote service provider. Communication device 401 transmits a request signal 405 towards receiving device 402. Receiving device 402 transmits an information request signal 406 to a service provider 403. The information request signal includes the communication ID for the communication device 401, as well as the request type which is to be provided . Knowing the communication ID for

device 401, the service provider 403 is able to communicate, e.g., using communication link 404, with communication device 401.

An example of this alternate embodiment might be that of a limousine service system. In this scenario, a business traveler may be at an unfamiliar airport and looking for a limousine to transport him to a hotel. Rather than hailing a limousine (he may not know the appropriate place in the airport where the limousines are located), the traveler can simply point his PAT 401 towards a receiving device 402 located on a wall in the airport terminal. Receiving device 402, in this case, might have a limousine icon (i.e., a pictorial representation, preferably one which is well recognized), or some other identifiable symbol or label to associate it with the type of service to be provided. The receiving device 402 then relays the communication ID of PAT 401 to a local limousine service (e.g., 403). The limousine service then contacts the traveler and arranges for him to be picked up at a particular location in the airport. Through the use of the invention, a service is provided without the traveler having to know the telephone number of the limousine service, or relying on the assistance of any third party.

FIG. 5 shows a simplified block diagram of a process by which a stand alone operation is remotely activated by the receiving device. PAT 501 requests, via request signal 504, that a stand alone operation 503 be activated. After receiving and decoding the request signal 504, receiving device 502 directs, via operation activation signal 505 transmitted over a wireline or a wireless network, operation 503 to commence. Examples of this alternate embodiment include remote opening of security gates, remote switching of appliances in the home, ordering products from special icon-based catalogs, etc.

FIG. 6 shows yet another embodiment of the invention in the form of a process which provides service information for the requestor. Communication device 601 requests, via request

signal 605, information about a particular service. Receiving device 602, in response to the request signal, then sends the requested information 606 back to communication device 601. Service information 606, which might be retrieved from a portion of the service database (201 shown in FIG. 2), may comprise a telephone number, menu selections, business hours, etc. Having the requested information, the communication device 601 may then initiate a communication with a service provider 603, via communication link 604. Examples of this embodiment include a requestor obtaining information about a restaurant, a local movie theater or other such service which is of interest to the requestor. The requestor might then elect to call the restaurant, for example, to make a dinner reservation for the evening. Like the operation activation embodiment shown in FIG. 5, the receiving device 602 might have an icon displayed thereon (e.g., symbol for a restaurant), to graphically show the type of service information which may be requested from a particular device.

FIG. 7 shows a simplified flow diagram 700 depicting the operation of a point and address transmitter device (PAT) in accordance with the invention. The process begins when the requestor enters (703) a request which corresponds to a predetermined set of request commands, e.g., via keypad 101 shown in FIG. 1. The request may also be input via a magnetic stripe card (which card may contain the requestor's ID, available request types, etc.) and read by card reader 110. A decision (704) is then reached which determines whether or not the entered request is a valid one. Request validity, in a preferred embodiment, is determined by whether or not the request matches one of a predetermined set, and whether the requestor has the authority to make a request of the type entered. If the request is found invalid, the PAT operator is notified, e.g., via a displayed (702) message, and the routine is directed back to the point in which the requestor enters (703) his request. If the request is

found to be valid, and the PAT is equipped with a lock indicator, e.g., a light beam guide 105 as shown in FIG. 1, the lock indicator is activated (701) until a locked condition is detected (705). Detection might include the user responding to a visual indication that the light beam is on target, or the system may have a feedback feature, whereby lock is automatically detected. In the alternative, where there is no such lock indicator, the directional antenna is engaged without having the feedback, either visual or automatic, indicating that the target has been properly acquired.)

Once the target is locked, where appropriate, the PAT transmits (706) a request signal, corresponding to the entered request type, toward the desired target. The request signal is transmitted via a probe means, which in a preferred embodiment is a directional antenna, aimed at the receiving device(s). The routine then tests (707) for a response to come back from the receiving device. A response signal, or so-called target information, may include system messages, communication ID's, confirmation notice, etc. Once a response is obtained, the PAT then performs (709) the appropriate system function, before the routine is exited (720). If no response is received, however, the routine determines (708) whether or not a predetermined time has expired. Such a time out check prevents the system from continually transmitting to a receiving device which is unable, for any reason, to respond to the request signal. Accordingly, after the predetermined time has elapsed, the operator of the PAT is notified of the cancellation, e.g., via a displayed (710) message, and the routine is exited (720). Otherwise, the routine is directed back to the point where the lock indicator is tested (705). (The present invention also contemplates an embodiment which allows the requestor to manually de-activate the request signal when, for example, he detects an indication that the request was received and is being processed).

Referring again to step 709, it should be noted that the PAT operation is determined, at least in part, by the request type entered (703) and the response received. In particular, the PAT might, in one instance, automatically establish a communication link with the target receiving device, as directed by a particular request type. In a second instance, the PAT might display information about a particular restaurant, or group of restaurants, which information was sent from the target device in response to a different request type. In like manner, the communication device requests, and responds to, various types of target information from the receiving device in accordance with the embodiments shown and described in FIGS. 3-6. Further, where the PAT receives a response from more than one receiving device, the PAT might be made capable of selecting, perhaps from a buffered list, a particular one of the responses received. The buffered list, e.g., descriptive text corresponding to the user of the responding device, might be kept locally in the PAT, or remotely through a separate service provider linked to the PAT. In either case, the operator of the PAT would have the ability to scroll through the buffered list, and select a desired one before the system function is performed (709).

FIG. 8 shows a simplified flow diagram 800 depicting the operation of a point and address receiving device (PAR) in accordance with the invention. The receiving device remains idle until a request signal is received (801). Once a request signal is received, the PAR decodes (807) the request signal, and tests (802) whether or not the request is of the service type. If the request is not a service request, i.e., the requestor is requesting information for which no special authorization is necessary, the receiving device must then determine (803) whether or not the information requested is valid (e.g., private access number for the receiver device, unavailable service, etc.). If the target information is invalid, the receiving device transmits (804) to

the requestor an appropriate response indicating the invalid condition. If the requested information is valid, the target information is encoded and sent (809) to the requesting communication device, and the routine is exited (820).

Referring again to the test (802), if the received request is of the service type, a test (805) is used to determine whether or not the requestor has the authorization to make such a request. The authorization data, like the service information, might reside in the service database (201 shown in FIG. 2). If the requestor is not authorized, the receiving device transmits (806) an appropriate response to the requesting communication device. If the requestor is authorized to make such a request, the receiving device then retrieves (810) the service information from the database. The encoded service information is then sent (808) to the appropriate operation or service provider, before the routine is exited (820).

What is claimed is:

Claims

1. Using a two-way communication device having directional probe means, a method of establishing a communication link, the method comprising the steps of:

at the communication device,

transmitting, via the probe means, a request signal substantially toward a receiving device;

receiving target information corresponding to said receiving device;

at the receiving device,

receiving said request signal; and

initiating, responsive to said step of receiving, a process which results in transmission of said target information to the communication device.

2. The method of claim 1, wherein the initiated process comprises the step of transmitting said target information directly to said communication device.

3. The method of claim 1, further comprising the step of, at the communication device, using the target information to establish a communication link with the receiving device.

4. The method of claim 1, further comprising the step of, at the receiving device, using the request signal to establish a communication link with the communication device.

5. The method of claim 1, wherein said step of receiving target information comprises the step of receiving a communication identification (ID) which is associated with said receiving device.

6. Using a two-way communication device having directional probe means, the communication device being a member of a communications network which provides the user of the communication device with a plurality of services and communications capabilities, which services and communications capabilities are determined, at least in part, by a set of network operating parameters, a method of configuring the communication network, the method comprising the steps of:

at the communication device,

generating a request signal corresponding to a desired communication network configuration;

transmitting, via the probe means, said request signal substantially toward a receiving device;

at the receiving device,

receiving said request signal; and

sending, responsive to said step of receiving, target information, such that said target information is usable in establishing the operating parameters.

7. The method of claim 6, wherein the step of sending comprises the step of initiating an operation corresponding to said request signal.

8. A two-way communication device for use in a communication network having a plurality of receiving devices which can be visually perceived by the user of the communication device, the communication network further providing the user of the communication device with a plurality of services and communications capabilities, the communication device comprising:

means for generating a request signal;

probe means for directionally transmitting said request signal to a visually perceived receiving device; and

means for processing target information corresponding to said visually perceived receiving device.

9. A two-way communication device for use in a communication network having a plurality of receiving devices which can be visually perceived by the user of the communication device, the communication network further providing the user of the communication device with a plurality of services and communications capabilities, the communication device comprising:

means for generating a request signal;

directional antenna means for transmitting said request signal to a visually perceived receiving device;

means for receiving target information corresponding to said visually perceived receiving device; and

means for processing said target information to establish a communication link with said receiving device.

10. A two-way communication device according to claim 9, wherein said means for processing comprises means for automatically establishing a communication link with a second communication device corresponding to said visually perceived receiving device.

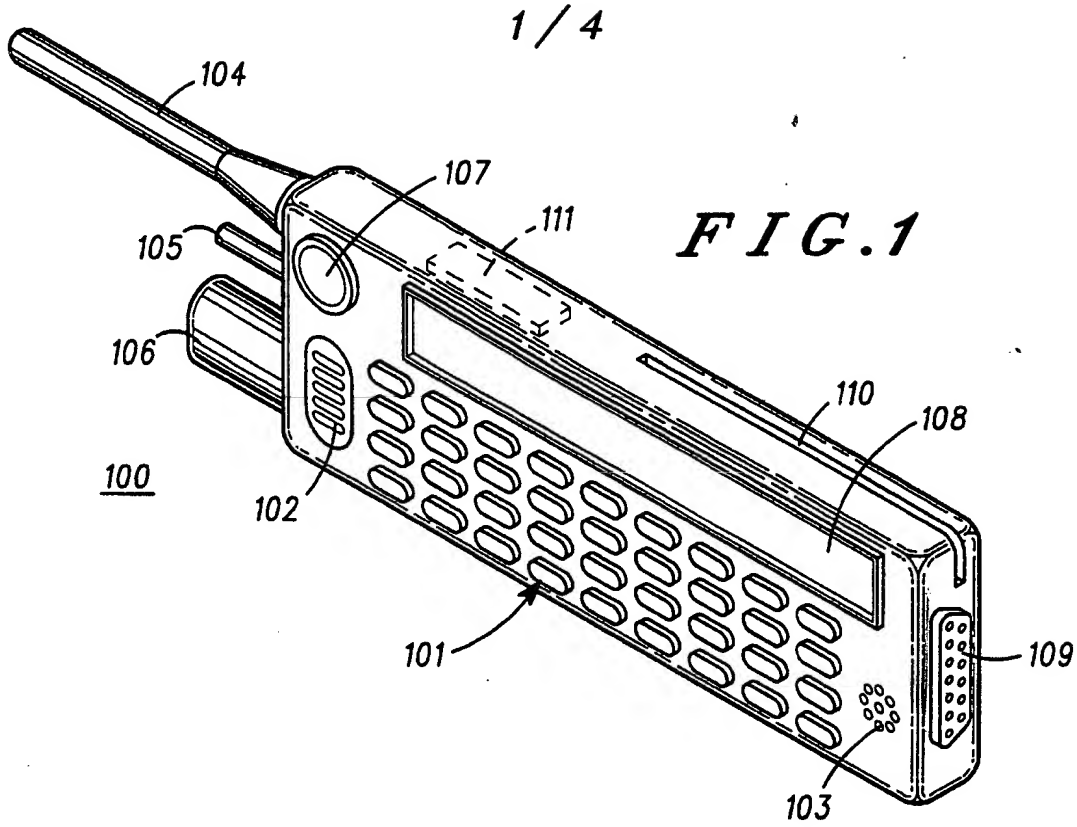


FIG. 1

FIG. 2

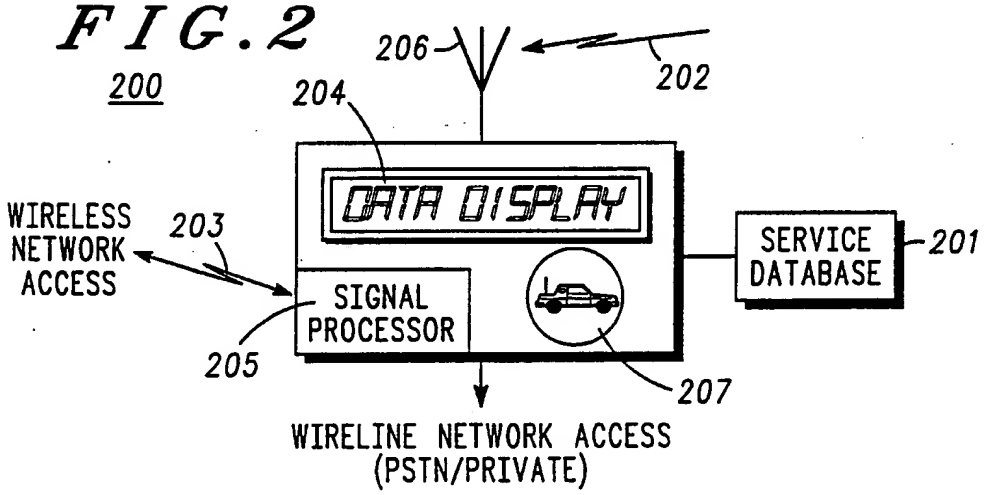


FIG. 3

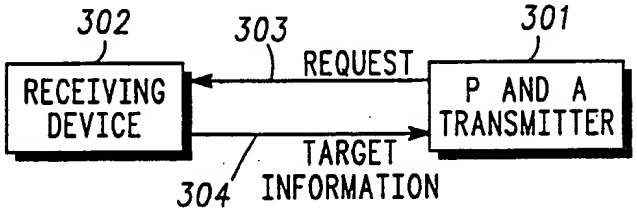


FIG.4

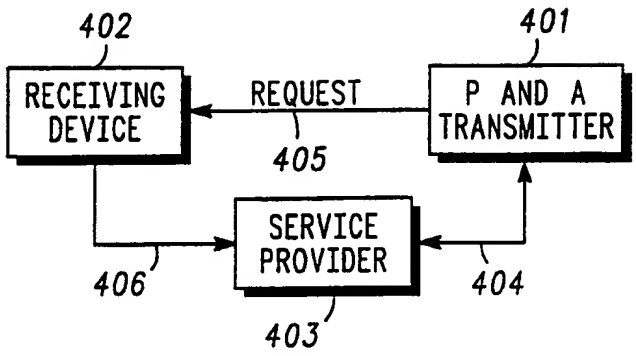


FIG.5

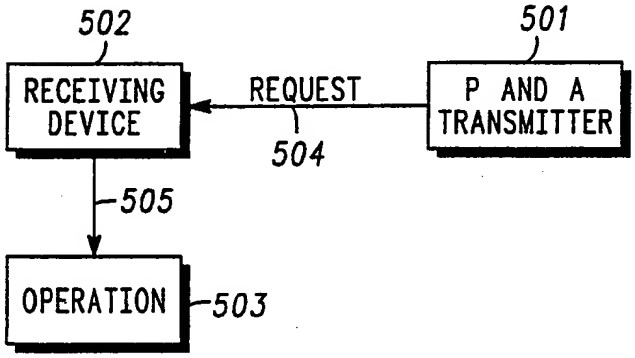


FIG.6

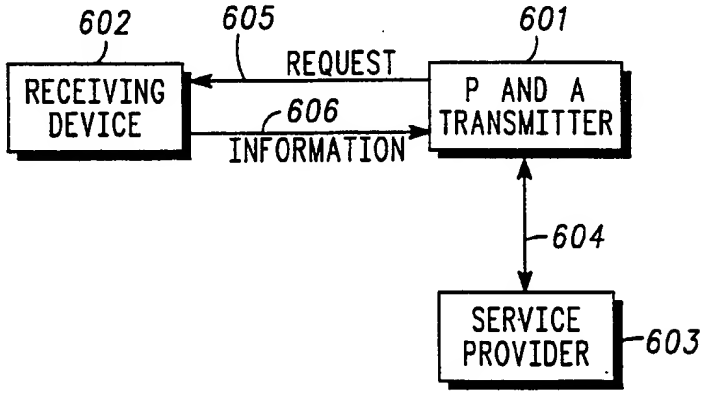


FIG.7

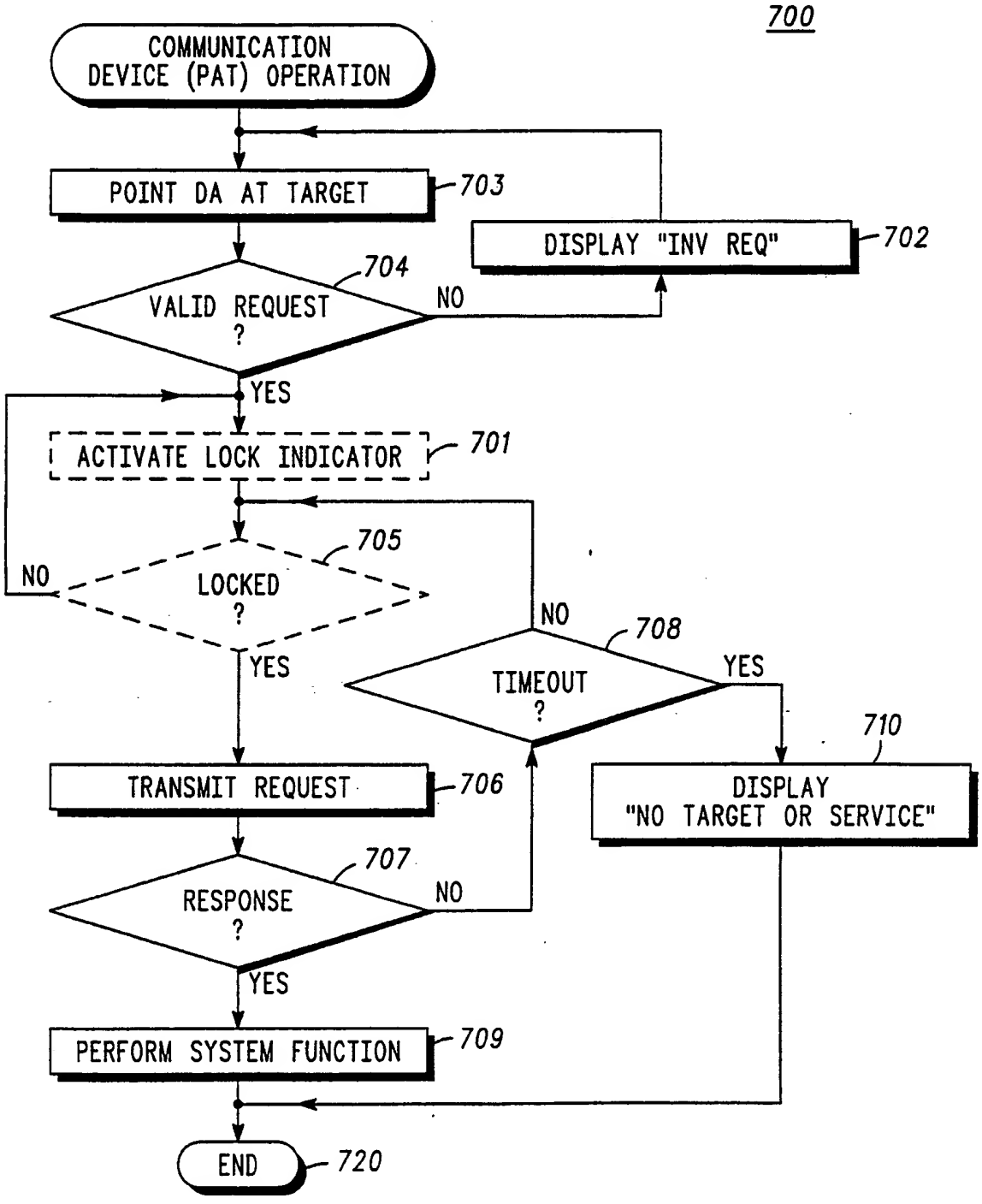
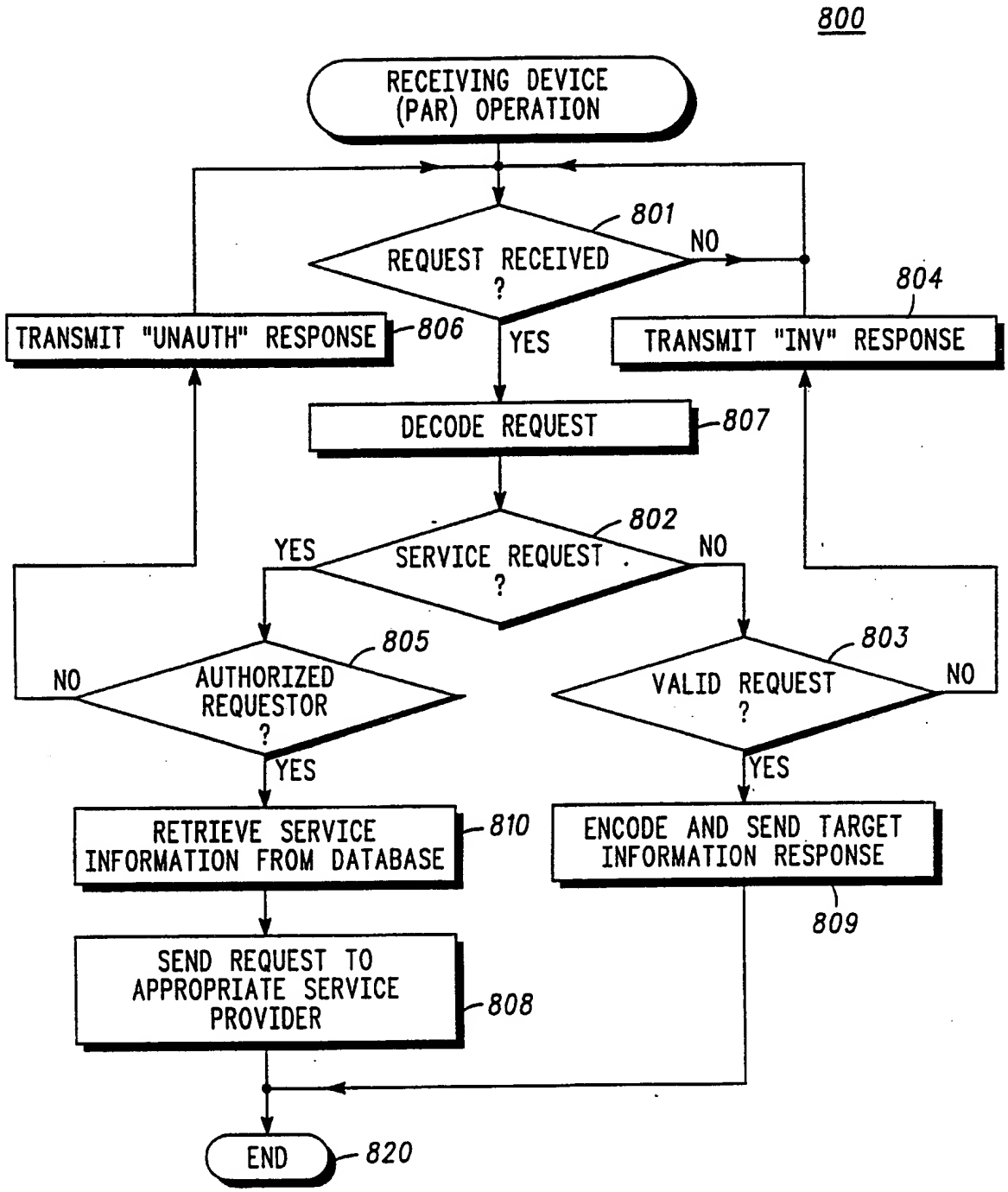

700
COMMUNICATION DEVICE (PAT) OPERATION
POINT DA AT TARGET
703
DISPLAY "INV REQ"
702
704
VALID REQUEST ?
NO
YES
ACTIVATE LOCK INDICATOR
701
705
NO
LOCKED ?
YES
NO
708
TIMEOUT ?
YES
710
TRANSMIT REQUEST
706
DISPLAY "NO TARGET OR SERVICE"
707
RESPONSE ?
NO
YES
PERFORM SYSTEM FUNCTION
709
END
720

FIG.8


800
RECEIVING DEVICE (PAR) OPERATION
801
REQUEST RECEIVED ?
NO
YES
804
TRANSMIT "UNAUTH" RESPONSE
806
TRANSMIT "INV" RESPONSE
DECODE REQUEST
807
802
SERVICE REQUEST ?
YES
NO
805
AUTHORIZED REQUESTOR ?
NO
803
VALID REQUEST ?
NO
YES
YES
RETRIEVE SERVICE INFORMATION FROM DATABASE
810
ENCODE AND SEND TARGET INFORMATION RESPONSE
809
SEND REQUEST TO APPROPRIATE SERVICE PROVIDER
808
END
820

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/11172

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :H04B 1/38
US CL :455/68,89; 340/825.54

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 455/70,88; 340286.06,286.11,330,825.44,825.26,825.27,825.59; 379/61

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,054,109 (BLACKBURN) 01 October 1991, See col. 1-6, figures 1,3a,3b,4.	1,3,6,8,9, 10
Y	US, A, 4,837,568 (SNAPER) 06 June 1989, See col. 1-6, figures 1,2,3.	1,2,4-8
A	US, A, 5,028,918 (GILES ET AL.) 02 July 1991, See col. 1-2, Fig. 1.	1,6,8,9
A	US, A, 3,898,619 (CARSTEN ET AL.) 05 August 1975, See col. 1-4, figures 1,2.	1,6,8,9

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
12 FEBRUARY 1993

Date of mailing of the international search report
23 MAR 1993

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. NOT APPLICABLE

Authorized officer
NGUYEN VO

Telephone No. (703) 305-4786

Form PCT/ISA/210 (second sheet)(July 1992)*